Remarks/Arguments

The Examiner is thanked for the careful review of this application. Claims 1-19 were previously cancelled and claims 20-38 are currently pending.

Rejections under 35 U.S.C. § 103(a)

The Office has rejected claims 20-22, 26-28, and 32-33 under 35 U.S.C. section 103(a) as being unpatentable over U.S. Patent No. 5,302,547 to Wojnarowski et al. (Wojnarowski) or U.S. Patent No 6,191,028 to Huang et al. (Huang) in view of U.S. Patent No 5,700,740 to Chen et al. (Chen). The Office has further rejected claims 23-25, 29-31, and 34-38 under 35 U.S.C. section 103(a) as being unpatentable over Wojnarowski or Huang in view of Chen as applied to claims 20-22, 26-28, and 32-33 further in view of U.S. Patent No. 4,861,732 to Fujimura et al. (Fujimura). Additionally, the Office has rejected claims 20-22, 26-28, and 32-33 under 35 U.S.C. section 103(a) as being unpatentable over Wojnarowski or Huang in view of U.S. Patent No U.S. Patent No. 6,150,272 to Liu et al. (Liu). Lastly, the Office has rejected claims 23-25, 29-31, and 34-38 under 35 U.S.C. section 103(a) as being unpatentable over Wojnarowski or Huang in view of Liu as applied to claims 20-22, 26-28, and 32-33 further in view of Fujimura.

For at least the reasons provided below, none of the combinations of the cited prior art raise a *prima facie* case of obviousness against the subject matter defined in independent claims 20, 26, and 34 because the requisite suggestion or motivation to combine the references in the manner proposed by the Office is lacking; the suggested combination fails to teach or suggest all of the features defined in independent claims 20, 26, and 34; Huang teaches away from using oxygen plasma or the alleged equivalence (SD mixture) to remove photoresist from over the organic low dielectric constant when the organic low dielectric constant is partially exposed; and Liu includes contradictory statements regarding the use of solvent ACT-690 when removing the photoresist layer.

Wojnarowski provides a method of fabricating low dielectric constant structures using low K dielectrics. As also acknowledged by the Office, however, Wojnarowski is silent as to the method of removing photoresist layer from over the nitride mask layer covering the low dielectric constant layer. Wojnarowski is further silent as to removing the photoresist layer from over the low constant dielectric without substantially damaging the low dielectric constant layer. In fact, in Wojnarowski, the portion of the low constant dielectric that is exposed during the photoresist removal is removed in the next plasma etch step. As such, damaging the exposed portion of the low constant dielectric can be of no consequence in Wojnarowski, as confirmed by Wojnarowski's failure to take any precautions to avoid removal of the underlying low K dielectric layer.

Chen teaches using a suitable solvent such as ACT-690 or ashing with an oxygen containing plasma to remove the photoresist layer defined over a dielectric such as SiO_2.

Contrary to the Office's interpretation, Chen is silent as to using low constant dielectric or an organic low constant dielectric layer. Chen further fails to disclose, teach, or suggest using the ACT-690 solvent or plasma etching when removing photoresist from over low constant dielectric layers. Rather, Chen discloses using dielectrics such as SiO_2, a standard dielectric known to have a higher dielectric constant than the low K dielectrics implemented in the subject application, as specifically provided by the Applicant. Additionally, Chen does not disclose, teach, or suggest removing of the photoresist from over the SiO_2 layer without substantially damaging the SiO_2 layer.

It must be noted that aside from being specifically directed at low constant dielectrics, Wojnarowski points out several disadvantages of using high dielectric constant materials that have about 3 or more dielectric constants in high density interconnects. As such, not only Wojnarowski does not disclose using dielectrics with high dielectric constants, Wojnarowski discourages one of ordinary skill in the art to implement dielectrics with high density. As such, one of ordinary skill in the art would not have implemented a photoresist removal method disclosed, taught, or suggested to be used with dielectrics with high dielectric constants such as SiO_2, as taught by Chen, to remove photoresist material in Wojnarowski wherein only low K dielectric layers are used and a great emphasis is placed on all the negative effects of using dielectrics with higher dielectric constants. Yet further, even if the oxide plasma or the solvent ACT-690 could have been used to remove photoresist from low dielectric constant layers (a proposition with which the Applicant disagrees), the combination still fails to teach or suggest that the latter two photoresist removal methods remove the photoresist from over the low dielectric constant dielectrics without substantially damaging the low dielectric constant layer, as neither Wojnarowski nor Chen teaches such a feature.

Additionally, Fujimura teaches immersing the substrate having the resist layer thereon in an etchant and applying an ultrasonic wave to improve the efficiency of the reaction and thus expediting removal of photoresist. Fujimura, however, does not teach, disclose, or suggest using a low dielectric constant material over the silicon substrate and removing of the photoresist from over such low K dielectric layer. Nor does Fujimura disclose, teach, or suggest that the photoresist is removed from over the substrate surface without substantially damaging the substrate surface.

Rather, Fujimura teaches the negative effects of using plasma etching to remove photoresist. As such, Fujimura discourages one of ordinary skill in the art from using oxygen plasma when removing the photoresist layer. Combining such teachings of Fujimura with direct encouragement of using oxygen plasma taught by Chen, reveals that the two references contradict one another on this issue. As such, even if the oxygen plasma method being used to remove photoresist from over the low K dielectrics were considered to be equivalent to using of solvent ACT-690 (a proposition with which the Applicant disagrees), one of ordinary skill in the art would not have arrived at the claimed invention, as the two references contradict one another on this point. Accordingly, following the Office's interpretation, the

two references would also contradict one another on using the equivalent method of solvent ACT-690.

The sections of Huang cited by the Office teach the advantages of using the organic low K dielectric layers and using plasma containing oxygen to remove the photoresist. The latter teachings have been acknowledged by the Office. However, the same section of Huang cited by the Office also teach that due to the organic low K dielectric including carbon, plasma etching the photoresist using oxygen plasma, thus negatively resulting in the removal of the organic low K dielectrics, as well. It is well-established that each of the prior art references must be considered in its entirety and as a whole, including portions that would lead away from the claimed invention. W.L. Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 91984). Thus, Huang, alone, teaches away from using plasma etching (as well as any alleged method equivalent to plasma etching) to remove photoresist from over low constant dielectric layers as well as organic low K dielectric layers.

Furthermore, Huang and Fujimura both teach away from using oxygen plasma to remove the photoresist due to the damage that can be caused to the underlying layer. Huang's and Fujimura's teachings on the latter point, however, contradict with Chen's teachings of using Oxygen plasma with SiO_2 . As the references are contradictory on using oxygen plasma, in contrast to the Office's interpretation, any combination of the cited prior art fails to suggest using oxygen plasma or the alleged equivalent ACT-690 solvent method to remove photoresist from over the low K dielectrics.

The Applicant also submits that when considering the entire Liu reference, Liu includes contradictory statements as to using of the solvent ACT-690 to remove the photoresist layer. In Liu, a photoresist layer is formed over a polymer dielectric layer, which in turn, is formed over an insulating layer such as SiO_2. In the portions cited by the Office, Liu teaches using for instance, ACT-690 to selectively remove the organic protective layer, without the ACT-690 attaching the low-dielectric polymer protective layer. See column 4, lines 38-43. In a different section, Liu teaches that the organic protective layer can also be removed by a wet cleaning in a solution of ACT-690. See column 5, lines 8-15. That is, the same composition of solvent ACT-690 that was used initially to remove the photoresist without damaging the underlying protective layer, can be used to remove the protective layer in the following operations (i.e., the same layer that could not have been removed by the ACT-690 initially). The two statements in Liu contradict one another. Thus, as Liu must be considered in its entirety and as a whole, including portions that would teach away from the claimed invention, Liu cannot be used to teach using of the (dimethyl Sulfoxide) included in the ACT-690 to remove photoresist from over the low K dielectric layers.

Thus, the combination of Huang and Liu fails to teach using the oxygen plasma or the use of the alleged equivalent, ACT-690 to remove the low K dielectric without substantially

damaging the low K dielectric layer. In the same manner, as described in more detail above, the combination of Huang, Liu, and Fujimura fails to disclose, teach, or suggest the claimed invention.

Lastly, the teachings of Liu with respect to using of the ACT-690 to remove the photoresist (the alleged method of photoresist removal equivalent to the oxygen plasma) and Fujimura's teachings not to use oxygen plasma to remove the photoresist are also contradictory. Additionally, Liu includes contradictory statements as to the use of ACT-690 when removing the photoresist layer as opposed to the protective layer, and the protective layer as opposed to the insulating layer. Thus, the references contradict one another on the same issue. Furthermore, as provided in more detail above, Wojnarowski fails to disclose the limitation of using dimethyl Sulfoxide (a chemical included in the ACT-690) to remove the photoresist layer from over the low K dielectric. Thus, the combination of Wojnarowski, Liu, and Fujimura also fails to teach the claimed invention.

Accordingly, it is respectfully submitted that independent claims 20, 26, and 34 are patentable over any combination of the cited art of record. Likewise, dependent claims 21-25, 27-33, and 35-38 are also submitted to be patentable over the cited art of record for at least the same reasons discussed above. Accordingly, the Applicant respectfully requests that the § 103(a) rejections be withdrawn.

In view of the foregoing, the Applicant respectfully submits that all of the pending claims 20-38 are in condition for allowance. Accordingly, a Notice of Allowance is respectfully requested. If the Examiner has any questions concerning the present Request for Reconsideration, the Examiner is kindly requested to contact the undersigned at (408) 749-6900, ext. 6913. If any fees are due in connection with filing this Request for Reconsideration, the Commissioner is also authorized to charge Deposit Account No. 50-0805 (Order No. LAM2P266).

Respectfully submitted,

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